IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of:

Applicant:	:	Allan Wirth
Serial No.	:	10/647,908
Filing Date	:	August 25, 2003
Title of Invention	:	METHOD AND APPARATUS FOR WAVEFRONT MEASUREMENT THAT RESOLVES THE 2π AMBIGUITY IN SUCH MEASUREMENT AND ADAPTIVE OPTICS SYSTEMS UTILIZING SAME
Examiner	:	n/a
Group Art Unit	:	n/a
Attorney Docket No.	:	108-133USANA0

Honorable Commissioner of Patents
and Trademarks
Washington, DC 20231

INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. 1.97

Sir:

In order to fulfill Applicant's continuing obligation of candor and good faith as set forth in 37 C.F.R. 1.56, Applicant submits herewith an Information Disclosure Statement prepared in accordance with 37 C.F.R Sections 1.97, 1.98 and 1.99.

The disclosures enclosed herewith are as follows:

U.S. PUBLICATIONS

NUMBER	FILING DATE	TITLE
6,278,100	May 4, 1999	SYNTHETIC GUIDE STAR FOR ON-ORBIT ASSEMBLY AND CONFIGURATION OF LARGE EARTH REMOTE SENSING OPTICAL SYSTEMS
6,184,974	July 1, 1999	APPARATUS AND METHOD FOR EVALUATING A TARGET LARGER THAN A MEASURING APERTURE OF A SENSOR
6,163,381	February 24, 1999	DUAL SENSOR ATMOSPHERIC CORRECTION SYSTEM
6,130,419	June 25, 1999	FIXED MOUNT WAVEFRONT SENSOR

6,113,242	January 15, 1999	ACTIVE EDGE CONTROLLED OPTICAL QUALITY MEMBRANE MIRROR
6,108,121	August 22, 2000	MICROMACHINED HIGH REFLECTANCE DEFORMABLE MIRROR
6,052,180	February 5, 1999	APPARATUS AND METHOD FOR CHARACTERIZING PULSED LIGHT BEAMS
5,936,720	July 7, 1998	BEAM CHARACTERIZATION BY WAVEFRONT SENSOR
5,912,731	December 4, 1997	HARTMANN-TYPE OPTICAL WAVEFRONT SENSOR
5,864,381	May 10, 1996	AUTOMATED PUPIL REMAPPING WITH BINARY OPTICS
5,798,878	November 12, 1996	SHAPE CONTROL APPARATUS FOR REFLECTING MIRRORS
5,629,765	May 13, 1997	WAVEFRONT MEASURING SYSTEM WITH INTEGRAL GEOMETRIC REFERENCE (IGR)
5,493,391	July 11, 1994	ONE DIMENSIONAL WAVEFRONT DISTORTION SENSOR COMPRISING A LENS ARRAY SYSTEM
5,317,389	May 30, 1990	METHOD AND APPARATUS FOR WHITE-LIGHT DISPERSED-FRINGE INTERFEROMETRIC MEASUREMENT OF CORNEAL TOPOGRAPHY
5,113,064	March 6, 1991	METHOD AND APPARATUS FOR PHASING SEGMENTED MIRROR ARRAYS
5,093,563	March 3, 1989	ELECTRONICALLY PHASED DETECTOR ARRAYS FOR OPTICAL IMAGING
4,737,621	December 6, 1985	INTEGRATED ADAPTIVE OPTICAL WAVEFRONT SENSING AND COMPENSATING SYSTEM

4,725,138	May 22, 1985	OPTICAL WAVEFRONT SENSING SYSTEM
4,696,573	July 3, 1985	DUAL SHEAR WAVEFRONT SENSOR
4,474,467	December 28, 1981	WAVEFRONT SENSOR USING A SURFACE ACOUSTIC WAVE DIFFRACTION GRATING
4,399,356	August 16, 1983	OPTICAL WAVEFRONT SENSING SYSTEM
4,257,686	December 14, 1978	MULTIPLE LAYER PIEZOELECTRIC WAVEFRONT MODULATOR
4,248,504	February 3, 1981	PIEZOELECTRIC WAVEFRONT MODULATOR
4,141,652	November 25, 1977	SENSOR SYSTEM FOR DETECTING WAVEFRONT DISTORTION IN A RETURN BEAM OF LIGHT

FOREIGN PUBLICATIONS

NUMBER	PUBLICATION DATE	TITLE
WO 97/21989	June 19, 1997	WAVEFRONT MEASURING SYSTEM WITH INTEGRAL GEOMETRIC REFERENCE (IGR)

TECHNICAL PUBLICATIONS

Web-based publication entitled "Absolute Distance Interferometry" by the Institute of Physics at E.M. Arndt University, http://www2.physik.uni-greifswald.de/laser/forschung/adi_eng.html, 2001, pages 1-3.

Chapter 1 of AOA's WaveScope System User Manual entitled "System Overview" by Adaptive Optics Associates, Inc., http://www.aoainc.com/technologies/adaptiveandmicrooptics/wavescope/CHAP6.html, 2001, pages 1-5.

Chapter 4 of AOA's WaveScope System User Manual entitled "Alignment" by Adaptive Optics

Associates, Inc., http://www.aoainc.com/technologies/adaptiveandmicroptics/wavescope/Alignment.htm, 2001, pages 1-25.

Chapter 5 of AOA's WaveScope System User Manual entitled "Calibration" by Adaptive Optics Associates, Inc., http://www.aoainc.com/technologies/adaptiveandmicrooptics/wavescope/Calibration., 2001, pages 1-23.

Chapter 8 of AOA's WaveScope System User Manual entitled "Basic Theory of Hartmann Sensing" by Adaptive Optics Associates, Inc., http://www.aoainc.com/technologies/adaptiveand microoptics/wavescope/CHAP2.html, 2001, pages 1-5.

Textbook entitled "Introduction to Adaptive Optics" by Tyson, Tutorial Texts in Optical Engineering, SPIE Press, Vol. TT41,2000, pages 1-117.

Web-based Publication entitled "Low-Cost Adaptive Optics" by University of Edinburgh et al., http://op.ph.ic.ac.uk/ao/locado.html, March 1999, pages 1-3.

Web-based Publication entitled "Two-frequency phase-shifting projection moire topography" by Kim et al., http://www.spie.org/web/abstracts/3500/3520.html, Vol. 3520, 1998, pages 36-42.

Web-based publication entitled "Interferometer satellite synthetic aperture radar and its application to the observation of Greenland ice sheet motion" by Frick, http://www.icg.tu-graz.ac.at/Education/Diplomarbeiten/1996/frick, 1996, pages 1-2.

Textbook entitled "Introduction to Wavefront Sensors" by Geary, Tutorial Texts in Optical Engineering, Vol. TT18, SPIE Optical Engineering Press, 1995, pages 1-169.

INTERNATIONAL SEARCH REPORTS

International App. No.	Filing Date
PCT/US01/22281	September 10, 2001

STATEMENT OF PERTINENCE

U.S. Patent No. 6,278,100 to Friedman et al. discloses an adaptive optic system for an earth-viewing telescope on board an orbiting spacecraft. The adaptive optic system includes a deformable mirror, a synthetic guide star laser, and a control module that corrects not only on-axis wavefront error but also off-axis wavefront error.

U.S. Patent No. 6,184,974 to Neal et al. discloses a Shack-Hartmann wavefront sensor

having an aperture which is smaller than the size of an object being measured which is used to measure the wavefront for the entire object. The wavefront sensor and the object are translated relative to one another to measure the wavefronts at a plurality of subregions of the object. The measured wavefronts are then stitched together to form a wavefront of the object. The subregions may overlap in at least one dimension. A reference surface may be provided to calibrate the wavefront sensor.

U.S. Patent No. 6,163,138 to Davies et al. discloses a dual sensor wavefront correction system that is adaptable to correcting wavefronts including wavefronts that are severely scintillated. The system includes a Hartmann wavefront sensor as well as a unit shear lateral shearing interferometer (LSI) wavefront sensor. The optical output signals from the Hartmann wavefront sensor are applied to a real reconstructor which provides an estimation of the distortion in the wavefront during most conditions except for conditions of severe turbulence. In order to provide compensation for the phase discontinuities in a scintillated wavefront, a unit shear lateral shearing interferometer (LSI) wavefront sensor is provided. The optical output signals form the unit shear LSI wavefront sensor are processed by a complex reconstructor in order to provide relatively accurate estimates of the tilt signals at the discontinuities. The output of the real reconstructor and the complex reconstructor are combined in a synergistic manner to provide a composite correction signal to the actuators of a deformable mirror. As such, the wavefront correction system has a relatively wide dynamic range and is not blind to discontinuities in the wavefronts as a result of turbulence. A steering mirror may also be provided to optimize the dynamic range of the deformable mirror.

U.S. Patent No. 6,130,419 to Neal discloses a rigid mount and method of mounting for a wavefront sensor. A wavefront dissector, such as a lenslet array, is rigidly mounted at a fixed distance relative to an imager such as a CCD camera, without need for a relay imaging lens therebetween.

U.S. Patent No. 6,133,242 to Marker et al. discloses a thin membrane which is mounted on an optically flat circular outer ring and stretched over a smaller optically flat circular inner ring. Differential pressure is applied to the annulus formed between the inner and outer rings to prestrain the membrane and separately applied to the inner ring where the mirror figure will be produced. The inner ring has a doubly curved top surface and is optically flat so that the membrane can freely move across the inner ring as incremental stress is applied via the annulus. A calculated combination of annulus stress and differential pressure on the inner ring produces an optical quality mirror figure in the inner ring area.

U.S. Patent No. 6,108,121 to Mansell et al. discloses a high reflectance deformable mirror which includes first and second substrates. The first substrate has formed therein a membrane having a bottom surface and a polished top surface. The top surface of the membrane forms the mirror surface and is preferably covered with a high reflectance coating. The first substrate also has formed therein at least one pillar for deforming the membrane. The pillar is integrally formed with the membrane and extends from the bottom surface of the membrane. The second substrate has at least one actuating member positioned thereon for actuating the pillar. Further, the first substrate is mounted to the second substrate such that the bottom surface of the membrane faces the second substrate. In a preferred embodiment, the actuating member comprises an electrode for applying an electrostatic force to the pillar. Also disclosed are single substrate embodiments of

the mirror and preferred methods for producing the mirror.

U.S. Patent No. 6,052,180 to Neal et al. discloses an apparatus and method for characterizing a pulsed energy beam with a two-dimensional wavefront sensor. The data acquisition is synchronized with the output of the beam from the pulsed source, so that a beam characterization, including phase, can be determined in a single pulse.

U.S. Patent No. 5,936,720 to Neal et al. discloses an apparatus and method for characterizing an energy beam (such as a laser) with a two-dimensional wavefront sensor, such as a Shack-Hartmann lenslet array. The sensor measures wavefront slope and irradiance of the beam at a single point on the beam and calculates a space-beamwidth product. A detector array such as a charge coupled device camera is preferably employed.

U.S. Patent No. 5,912,731 to DeLong et al. discloses an optical wavefront sensor for measuring phase tilt in two dimensions across the cross section of a beam, using only a single lenslet array and a single camera sensor array. The rectangular lenslet array is oriented at 45 degrees to first and second orthogonal sets of axes defining multiple points of interest in the beam cross section, such that each lenslet subaperture is centered (at 40) between adjacent points of interest on the first and second axes. The points of interest are locations corresponding to the positions of actuators in an adaptive optics system. The camera sensor array has more cells per unit area than are subapertures per unit area. Only selected cells are activated, to provide for measurements at the approximate mid-points of lines between adjacent points of interest on the first and second orthogonal axes. Thus the sensor array has enough active cells to effect measurements in both orthogonal directions without interference between the cells used for measurement in the two directions, and without the need for multiple lenslet arrays or sensor arrays.

U.S. Patent No. 5,864,381 to Neal et al. discloses methods and apparatuses for pupil remapping employing non-standard lenslet shapes in arrays; divergence of lenslet focal spots from on-axis arrangements; use of lenslet arrays to resize two-dimensional inputs to the array; and use of lenslet arrays to map an aperture shape to a different detector shape. Applications include wavefront sensing, astronomical applications, optical interconnects, keylocks, and other binary optics and diffractive optics applications.

U.S. Patent No. 5,798,878 to Asari et al. discloses a reflecting mirror approximated by a non-constrained circular plate having a similar mechanical structure, and an eigenfunction value arithmetic unit which calculates values of Bessel-Fourier functions which are eigenfunctions of free vibrations of the circular plate. Using these function values, a mode displacement identification unit approximates a required mirror displacement, which is necessary to correct for wavefront distortion, with a linear combination up to a prescribed mode of vibration of the eigenfunction. A support mechanism command unit controls an actuator so that the value of the linear combination function equals the amount of mirror displacement at a position supported by a reflecting mirror support mechanism.

U.S. Patent No. 5,629,765 to Schmutz describes a geometric sensor which includes a Monolithic Lenslet Module (MLM) subaperture array having a plurality of microlenses, each of which have an opaque center formed concentric with the microlens optical axis, at the location of

the lens chief ray, to produce an integral geometric reference (IGR) spot pattern of the lens array which is used to correct for sensor errors to an accuracy comparable with that achieved with reference plane wave calibration.

U.S. Patent No. 5,493,391 to Neal et al. discloses a 1-dimensional sensor for measuring wavefront distortion of a light beam as a function of time and spatial position which includes a lens system that incorporates a linear array of lenses, and a detector system which incorporates a linear array of light detectors positioned from the lens system so that light passing through any of the lenses is focused on at least one of the light detectors. The 1-dimensional sensor determines the slope of the wavefront by location of the detectors illuminated by the light. The 1-dimensional sensor has much great bandwidth than that of the 2-dimensional systems.

U.S. Patent No. 5,317,389 to Hochberg et al. discloses a novel interferometric apparatus and method for measuring the topography of aspheric surfaces, without requiring any form of scanning or phase shifting. The apparatus and method of the present invention utilize a white-light interferometer, such as a white-light Twyman-Green interferometer, combined with a means for dispersing a polychromatic interference pattern, using a fiber-optic bundle and a disperser such as a prism for determining the monochromatic spectral intensities of the polychromatic interference pattern which intensities uniquely define the optical path differences or OPD between the surface under test and a reference surface such as a reference sphere. Consequently, the present invention comprises a "snapshot" approach to measuring aspheric surface topographies such as the human cornea, thereby obviating vibration sensitive scanning which would otherwise reduce the accuracy of the measurement. The invention utilizes a polychromatic interference pattern in the pupil image plane, which is dispersed on a point-wise basis, by using a special area-to-line fiber-optic manifold, onto a CCD or other type detector comprising a plurality of columns of pixels. Each such column is dedicated to a single point of the fringe pattern for enabling determination of the spectral content of the pattern. The auto-correlation of the dispersed spectrum of the fringe pattern is uniquely characteristic of a particular optical path difference between the surface under test and a reference surface.

U.S. Patent No. 5,113,064 to Manhart discloses a method and apparatus for edge phasing an array of segments in a segmented primary telescope mirror using white light from a far field source and starting with the inner edge of each segment in the first ring of segments. The segments are individually phased for zero piston and tilt error with respect to the edge of a reference surface in the open center position of the telescope mirror, and proceeding from ring to ring by edge phasing one edge of each segment in each subsequent ring with an edge of a segment in a preceding ring that has been edge phased. After edge phasing of all segments in the telescope mirror array has been completed, full surface phasing can be achieved using a conventional Shack-Hartmann technique followed by finding the RMS best fit for each segment of the mirror array.

U.S. Patent No. 5,093,563 to Small et al. discloses an optical imaging system which includes an array of small aperture subtelescopes each with heterodyne detectors. The array detects the amplitude and phase of light waves emanating from a scene under observation before they are combined into an image. The beam combining and interfering functions are performed after detection by the use of novel electronic signal processing. Large-aperture resolution is synthesized by electronically detecting and correcting phase errors without optical phase compensating components. Parallel processing and atmospheric turbulence compensation are

achieved. The system images laser illuminated or naturally illuminated targets as well as stationary or moving targets. The heterodyne detectors can also achieve similar results when arranged in a pupil plane array located behind a single large aperture telescope.

U.S. Patent No. 4,737,621 to Gonsiorownski et al. discloses a wavefront sensing and compensating system for detecting and correcting for distortion in light wavefronts in which the wavefront is divided into a plurality of subapertures and light intensified and imaged as spots of light from each subaperture onto a detector array. The individual detector elements of the array form a plurality of electrical signals proportional to the local divergence of the vector gradient field. This signal after interfacing or reconstruction is applied to corrective mirrors which may be of the deformable or membrane type.

U.S. Patent No. 4,725,138 to Wirth et al. discloses a wavefront sensor for detecting distortion in light wavefronts in which the wavefront is divided into a plurality of subapertures and light amplified or intensified and images as spots of light from each subaperture onto a filter mask. The filter mask encodes a predetermined function of the spot intensity distributor onto the light intensity of the spot transmitted through the filter. For spot centroid calculation, the function is linearly variable. Mask embodiments include linearly varying alternate opaque and transparent chevrons, electronically variable chevrons, and quadratically varying chevrons.

U.S. Patent No. 4.696,573 to Hutchin discloses a wavefront of light which is focused upon a first shearing interferometer having a relatively large shear and small dynamic range and a relatively minor portion of the light which is focused upon a second shearing interferometer having a relatively small shear but large dynamic range. Owing to the limited dynamic range of the first shearing interferometer, a plurality of a plurality of virtual candidate measurements are manifest which are compared with the temporally and/or spatially averaged values of each measurement produced by the second shearing interferometer and the closest match is employed to obtain a highly accurate unambiguous reading of the wavefront slope measurements.

U.S. Patent No. 4,474,467 to Hardy et al. discloses a wavefront sensor for detecting the slope of an input wavefront. A surface acoustic wave reflective diffraction grating is positioned at a focal point of the wavefront, and generates surface acoustic waves at two primary frequencies. The reflective diffraction grating produces a first AC shearing interferogram between two like diffraction orders generated by the surface acoustic waves. A photodetector array is positioned to detect the shearing interferogram at a two dimensional array of zones, and the phase of the output signal for each zone is representative of the local slope of the wavefront in the direction of shearing, thus producing the slope in one direction. Complete two dimensional wavefront slope information is obtained by shearing the wavefront in a second orthogonal direction in substantially the same manner utilizing a second surface acoustic wave diffraction grating and a second photodetector array.

U.S. Patent No. 4,399,356 to Feinleib et al. discloses an improved light waveform image sensing system. The image wavefront is focused on an image divider and divided into "n"-segments ("n">1) whereupon the "n"-segments are focused on "n"-detector arrays and detected by "S"-detectors "S">>1) in the "n"-detector arrays. The "S"-detectors may comprise any of the well-known photosensitive elements. A particular useful detector is an electron-beam mode device. The detected signals are combined to produce an electrical signal proportional to the tilt in the

wavefront which signal may be used to deform a deformable mirror thereby correcting the image.

U.S. Patent No. 4,257,686 to Albertinetti et al. discloses a wavefront modulator which includes a multiple layer unitary block of a piezoelectric medium having a mirror bonded to the uppermost surface of the block. First and second sets of electrodes are formed within the block at each of a plurality of discrete electrically-addressable locations, such that the electrodes of the first set are positioned at one side of each of the layers, and the electrodes of the second set are positioned at opposite sides of each of the layers in order to increase the sensitivity of response of the modulator to in turn decrease the requisite driving or control voltages. The first and second sets of electrodes are offset with respect to each other to provide for ease of electrical access to each electrode of each set.

U.S. Patent No. 4,248,504 to Albertinetti et al. discloses a piezoelectric wavefront modulator which employs a plurality of widely-separated posts, which are formed upon the upper portion of a monolithic piezoelectric medium and are affixed to the lower portion of a flexible mirror. The posts extend from the top surface of the piezoelectric medium a sufficient distance, so that the mirror floats. The posts are surrounded by moats formed within the medium, which are configured to produce a highly sensitive device, wherein the post mirror actuators are substantially electromechanically isolated from each other but not from the piezoelectric material adjacent the moat.

U.S. Patent No. 4,141,652 to Feinleib discloses an improved apparatus for sensing wavefront distortions in a return beam of light, such as a beam returned through a turbulent atmosphere or through an imperfect optical system from a radiating or illuminated object. This apparatus includes the components typically present in a Hartmann-type wavefront sensor, and additionally includes means to provide a modulated reference beam of light which is combined with the return beam. The use of a modulated reference beam eliminates the necessity for precise optical alignment, which is difficult or impossible to maintain in most operating environments.

WIPO Publication No. WO 97/21989 By Adaptive Optics Associates, Inc. discloses a geometric sensor which includes a Monolithic Lenslet Module (MLM) subaperture array having a plurality of microlenses, each of which have an opaque center marking formed concentric with the microlens optical axis, at the location of the lens chief ray, to produce an integral geometric reference (IGR) spot pattern of the lens array which is used to correct for sensor errors to an accuracy comparable with that achieved with reference plane wave calibration.

The web-based publication entitled "Absolute Distance Interferometry" describes the development of a new, highly accurate method for distance measurement on the basis of a laser interferometer.

Chapter 1 of AOA's WaveScope Systems User Manual entitled "System Overview" describes the WaveScope System which consists of several separate units that are connected via shielded cables.

Chapter 8 of AOA's WaveScope System User Manual entitled "Basic Theory of Hartmann Sensing" describes WaveScope as a Hartmann-style wavefront sensor.

Chapter 5 of AOA's WaveScope System User Manual entitled "Calibration" describes the basic calibration of a Hartmann wavefront sensor, which is the determination of the conversion factor between subaperture spot motion and wavefront tilt. In the case of the WaveScope sensor, this conversion factor is set by the distance that the stage moves from the pupil image plane to the plane of best spot focus, and by the size of the individual lenslet elements.

Chapter 4 of AOA's WaveScope System User Manual entitled "Alignment" describes the primary purpose of alignment as to locate WaveScope in space so that the user's light source enters the system roughly centered on WaveScope's MLM and approximately aligned with the optical axis of the MLM. The second purpose is to allow the user to verify that WaveScope is actually looking at what he/she thinks it should be looking at.

The textbook entitled "Introduction to Adaptive Optics" by Tyson provides an introduction to adaptive optics and its methods, systems and technology.

The webpage for "Low-Cost Adaptive Optics" describes a project put on by the University of Edinburgh et al. from October 1996 to December 1998, which studied techniques whereby an optical system can maintain a high performance in the presence of environmental or other factors that would normally cause poor performance. An adaptive optical system incorporates a wavefront sensor, control sytsem and deformable mirror (or transmissive device) that operates together in closed loop to maintain a high quality image or beam.

The web-based scientific publication entitled "Two-frequency phase-shifting projection moire topography" by Kim et al. describes an adopting phase-shifting technique in moire topography which provides many advantages in measuring complex surface profiles with varying reflectance. However, still the so-called 2π ambiguity problem remains, which limits the maximum measurable step height difference between two neighboring sample points to be less than half the equivalent wavelength of moire fringes. To cope with 2π-ambiguity, a two-wavelength scheme of projection moire topography is proposed along with necessary hardware design considerations.

The web-based publication entitled "Interferometer satellite synthetic aperture radar and its application to the observation of Greenland ice sheet motion" by Frick describes a study in which satellite radar interferometry was applied to the observation of Greenland ice sheet motion.

The textbook entitled "Introduction to Wavefront Sensors" by Geary describes the nature of wavefront sensors, as well as the parameters for wavefront sensor measurement, direct wavefront sensing, indirect wavefront measurement, wavefront sensor characterization and calibration, comparison of wavefront sensor techniques, wavefront sensors and adaptive optics, and intensity-based wavefront sensing.

A separate listing of the above references on PTO Form 1449 and copies of these references are enclosed herewith for the convenience of the Examiner.

Respectfully submitted,

Dated: January 22, 2004

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Substitute for form 1449A/PTO

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

Sheet	1	of	5

Complete If Known	
Application Number	10/647,908
Filing Date	August 25, 2003
First Name Inventor	Allan Wirth
Group Art Unit	N/a
Examiner Name	N/a
Attorney Docket Number	108-133USANA0

U.S. PATENT DOCUMENTS

Examiner Initials	Cite No.	U.S. Patent Documents Number	Kind Code (if known)	Name of Patentee or Applicant of Cited Document	Date of Publication of Cited Document MM-DD-YYYY	Intn'l Class / Sub Class
		6,278,100		Friedman et al.	08/21/2001	G02B 23/00
		6,184,974		Neal et al.	02/06/2001	G01J 1/20
		6,163,381		Davies et al.	12/19/2000	G01B 9/02
		6,130,419		Neal	10/10/2000	G01J 1/20
		6,113,242		Marker et al.	09/05/2000	G02B 5/08
		6,108,121		Mansell et al.	08/22/2000	G02B 26/08
		6,052,180		Neal et al.	04/18/2000	G01J 1/00
		5,936,720		Neal et al.	08/10/1999	G01J 1/00
		5,912,731		DeLong et al.	06/15/1999	G01J 1/00
		5,864,381		Neal et al.	01/26/1999	A61B 3/00
		5,798,878		Asari et al.	08/25/1998	G02B 5/08

U.S. PATENT DOCUMENTS

Examiner Initials	Cite No.	U.S. Patent Documents Number	Kind Code (if known)	Name of Patentee or Applicant of Cited Document	Date of Publication of Cited Document MM-DD-YYYY	Intn'l Class / Sub Class
		5,629,765		Schumtz	05/13/1997	G01J 1/20
		5,493,391		Neal et al.	02/20/1996	G01J 1/00
		5,317,389		Hochberg et al.	05/31/1994	G01B 11/06
		5,113,064		Manhart	05/12/1992	
		5,093,563		Small et al.	03/03/1992	
		4,737,621		Gonsiorowski et al.	04/12/1988	G01J 1/20
		4,725,138		Wirth et al.	02/16/1988	G01J 1/20
		4,696,573		Hutchin	09/29/1987	G01B 9/02
		4,474,467		Hardy et al.	10/02/1984	G01B 9/02
		4,399,356		Feinleib et al.	08/16/1983	G01J 1/20
		4,257,686		Albertinetti et al.	03/24/1981	
		4,248,504		Albertinetti et al.	02/03/1981	
		4,141,652		Feinleib	02/27/1979	G01J 1/20

PUBLICATIONS		
Examiner Initials	Cite No.	Description
		Web-based publication entitled "Absolute Distance Interferometry" by the Institute of Physics at E.M. Arndt University, http://www2.physik.uni-greifswald.de/laser/forschung/adi_eng.html, 2001, pages 1-3.
		Chapter 1 of AOA's WaveScope System User Manual entitled "System Overview" by Adaptive Optics Associates, Inc., http://www.aoainc.com/technologies/adaptiveandmicrooptics/wavescope/CHAP6.html, 2001, pages 1-5.
		Chapter 4 of AOA's WaveScope System User Manual entitled "Alignment" by Adaptive Optics Associates, Inc., http://www.aoainc.com/technologies/adaptiveandmicroptics/wavescope/Alignment.htm, 2001, pages 1-25.
		Chapter 5 of AOA's WaveScope System User Manual entitled "Calibration" by Adaptive Optics Associates, Inc., http://www.aoainc.com/technologies/adaptiveandmicrooptics/wavescope/Calibration., 2001, pages 1-23.
		Chapter 8 of AOA's WaveScope System User Manual entitled "Basic Theory of Hartmann Sensing" by Adaptive Optics Associates, Inc., http://www.aoainc.com/technologies/adaptiveand microoptics/wavescope/CHAP2.html, 2001, pages 1-5.
		Textbook entitled "Introduction to Adaptive Optics" by Tyson, Tutorial Texts in Optical Engineering, SPIE Press, Vol. TT41,2000, pages 1-117.
		Web-based Publication entitled "Low-Cost Adaptive Optics" by University of Edinburgh et al., http://op.ph.ic.ac.uk/ao/locado.html, March 1999, pages 1-3.
		Web-based Publication entitled "Two-frequency phase-shifting projection moire topography" by Kim et al., http://www.spie.org/web/abstracts/3500/3520.html, Vol. 3520, 1998, pages 36-42.
		Web-based publication entitled "Interferometer satellite synthetic aperture radar and its application to the observation of Greenland ice sheet motion" by Frick, http://www.icg.tu-graz.ac.at/Education/Diplomarbeiten/1996/frick, 1996, pages 1-2.
		Textbook entitled "Introduction to Wavefront Sensors" by Geary, Tutorial Texts in Optical Engineering, Vol. TT18, SPIE Optical Engineering Press, 1995, pages 1-169.

FOREIGN PATENT DOCUMENTS								
Examiner Initials		Foreign Patent Document			Name of Patentee or Applicant of Cited Document	Date of Publication of Cited Document MM-DD-YYYY	Intn'l Class / Sub Class	T *
		Number	Kind Code (if known)					
		PCT	WO 97/21989		Adaptive Optics Associates, Inc., Cambridge MA	06/19/1997	G01J 9/00	

PUBLICATIONS		
Examiner Initials	Cite No.	Description
		Search Report for International Application No. PCT/US01/22281, 2001

EXAMINER **DATE CONSIDERED**

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance not considered. Include copy of this form with next communication to applicant.

(INFORMATION DISCLOSURE STATEMENT – SECTION 9 PTO-1449)